

## PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY  
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference <b>55776 PCT SB/MW</b>	<b>FOR FURTHER ACTION</b> See Form PCT/IPEA/416	
International application No. <b>PCT/SE2004/001322</b>	International filing date (day/month/year) <b>20-09-2004</b>	Priority date (day/month/year) <b>17-10-2003</b>
International Patent Classification (IPC) or national classification and IPC <b>See Supplemental Box</b>		
Applicant <b>Alfa Laval Corporate AB et al</b>		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
- a. ☒ (sent to the applicant and to the International Bureau) a total of 5 sheets, as follows:
- ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
- ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
- b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) \_\_\_\_\_, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).
4. This report contains indications relating to the following items:
- ☒ Box No. I Basis of the report
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

Date of submission of the demand <b>20-04-2005</b>	Date of completion of this report <b>24-06-2006</b>
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<sup>4</sup>  
**INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY**

International application No.

PCT/SE2004/001322

**Supplemental Box**

In case the space in any of the preceding boxes is not sufficient.  
Continuation of: Cover sheet

**INTERNATIONAL PATENT CLASSIFICATION (IPC) :**

**F28F 9/16** (2006.01)

**B21D 53/04** (2006.01)

**B23K 1/00** (2006.01)

# INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/SE2004/001322

## Box No. I Basis of the report

1. With regard to the language, this report is based on:



the international application in the language in which it was filed



a translation of the international application into \_\_\_\_\_,  
which is the language of a translation furnished for the purposes of:



international search (Rules 12.3(a) and 23.1(b))



publication of the international application (Rule 12.4(a))



international preliminary examination (Rules 55.2(a) and/or 55.3(a))

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:



the international application as originally filed/furnished



the description:

pages 1 - 10 as originally filed/furnished

pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_

pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_



the claims:

pages \_\_\_\_\_ as originally filed/furnished

pages\* \_\_\_\_\_ as amended (together with any statement) under Article 19

pages\* 11 - 15 received by this Authority on 20 - 01 - 2006

pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_



the drawings:

pages 1 - 2 as originally filed/furnished

pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_

pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_



a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:



the description, pages \_\_\_\_\_



the claims, Nos. \_\_\_\_\_



the drawings, sheets/figs \_\_\_\_\_



the sequence listing (*specify*): \_\_\_\_\_



any table(s) related to the sequence listing (*specify*): \_\_\_\_\_

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).



the description, pages \_\_\_\_\_



the claims, Nos. \_\_\_\_\_



the drawings, sheets/figs \_\_\_\_\_



the sequence listing (*specify*): \_\_\_\_\_



any table(s) related to the sequence listing (*specify*): \_\_\_\_\_

\* If item 4 applies, some or all of those sheets may be marked "superseded."

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/SE2004/001322

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

## 1. Statement

Novelty (N)	Claims	<u>1-30</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>2, 20</u>	YES
	Claims	<u>1, 3-19, 21-30</u>	NO
Industrial applicability (IA)	Claims	<u>1-30</u>	YES
	Claims		NO

## 2. Citations and explanations (Rule 70.7)

The invention relates to a stainless steel heat exchanger with brazed connections. Normally, particularly aggressive fluxes are necessary due to the presence of chrome dioxide on stainless steel surfaces. In order to improve the brazeability, the contact surface comprises a material that allows a simpler brazing procedure than stainless steel.

Reference is made to the following documents:

D1: GB820153 A  
D2: US4223826 A  
D3: GB2322323 A  
D4: WO03058142 A1  
D5: DE19805439 A1

where D1 and D2 are considered particularly relevant.

D2 teaches how stainless-steel components may be brazed to either stainless steel or another metal via a layer of copper plating acting as a primer for the solder.

D1 relates to the problem that solder is prevented from wetting the components in a heat exchanger. The problem is solved by vacuum plating or chemical deposition of a layer of a metal or alloy on the surface before brazing. Nickel or copper are given as examples. The device according to D1 differs from the content of claim 1 in that the components are made of aluminium rather than stainless steel. Furthermore, although the main claim in D1 is not directed towards any specific kind of heat exchanger, the illustrated embodiment is

.../...

## Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of: BOX V

a tubular heat exchanger.

In view of D2, it is obvious to a person skilled in the art to apply the solution according to D1 with a similar effect on a plate heat exchanger of a different material (stainless steel) with poor brazeability, thereby arriving at a device according to claim 1 and a manufacturing process according to claim 19. Hence, the content of these claims does not involve an inventive step.

The suitability of nickel in the brazing area of a steel component is not mentioned in D2, and is not considered to be an obvious choice in this case. Hence, the invention claimed in claims 2 and 20 is novel, is considered to involve an inventive step and to be industrially applicable.

The remaining claims are merely considered to involve particular detail executions and steps obvious to a person skilled in the art. Therefore, the invention according to these claims is not considered to involve an inventive step.

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

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Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

The term "includes" used in the characterising portion of claim 1 is vague and unclear and leaves the reader in doubt as to the meaning of the technical feature to which it refers, thereby rendering the definition of the subject-matter of said claim unclear (Article 6 PCT).

Claim 4 is trivial, stating that a brazed connection is achieved by a brazing process.

Claim 13 does not give sufficient indication of just how the material is applied "by means of and during" the brazing process.

Claims

1. A plate heat exchanger including a number of heat  
exchanger plates (1, 1', 1''), which are arranged beside each  
5 other and connected to each other by means of a braze  
connection,  
wherein the heat exchanger plates (1, 1', 1'') are substantially  
manufactured in stainless steel containing chromium,  
wherein the plate heat exchanger includes a number of port  
10 channels (4) extending through at least some of the heat  
exchanger plates, and  
wherein one or more of the port channels (4) are surrounded by  
a connection surface (5) for connection of the port channel to a  
pipe member (6),  
15 characterised in that the connection surface (5) includes a  
material that permits brazing of said pipe member (6) to the  
connection surface (5) in a more easy manner than to stainless  
steel, wherein said material is more reduction susceptible than  
chromium dioxide.  
20
2. A plate heat exchanger according to claim 1, characterised  
in that said material includes nickel.
3. A plate heat exchanger according to anyone of claims 1  
25 and 2, characterised in that said material includes copper.
4. A plate heat exchanger according to anyone of the  
preceding claims, characterised in that said braze connection of  
the heat exchanger plates is accomplished by a braze process.  
30
5. A plate heat exchanger according to anyone of the  
preceding claims, characterised in that said material is bound to  
the stainless steel through diffusion.

6. A plate heat exchanger according to claims 4 and 5, characterised in that said diffusion is accomplished during said braze process.

5 7. A plate heat exchanger according to anyone of the preceding claims, characterised in that one of said heat exchanger plates (1, 1', 1'') forms an outer heat exchanger plate (1') which has a respective outer surface area surrounding a respective port channel.

10

8. A plate heat exchanger according to claim 7, characterised in that said material is supplied to the outer surface area for forming said connection surface (5).

15 9. A plate heat exchanger according to anyone of the preceding claims, characterised in that the plate heat exchanger includes a connection member (8; 9) at each port channel (4), wherein the connection member (8, 9) forms said connection surface (5).

20

10. A plate heat exchanger according to claims 7 and 9, characterised in that the connection member (8, 9) is attached to outer surface area.

25 11. A plate heat exchanger according to anyone of claims 9 and 10, characterised in that the connection member (8, 9) has a primary surface onto which said material is applied for forming said connection surface (5).

30 12. A plate heat exchanger according to claim 11, characterised in that the primary surface has a rough surface finish, which is accomplished through abrasive blasting or any similar roughening process and which facilitates wetting of the primary surface with said material.

35



13. A plate heat exchanger according to claims 4 and 12, characterised in that said material has been applied onto the primary surface by means of and during the braze process.
- 5 14. A plate heat exchanger according to anyone of claims 9 to 13, characterised in that the connection member (8,9) is substantially manufactured in a stainless containing chromium.
- 10 15. A plate heat exchanger according to anyone of claims 9 and 10, characterised in that the connection member (8, 9) is manufactured in an alloy substantially containing copper and nickel.
- 15 16. A plate heat exchanger according to claim 15, characterised in that said alloy contains 55 to 95 percent by weight copper and 5 to 45 percent by weight nickel.
- 20 17. A plate heat exchanger according to anyone of claims 9 and 16, characterised in that the connection member is designed as a pipe nipple (8).
- 25 18. A plate heat exchanger according to anyone of claims 9 and 16, characterised in that the connection member is designed as a washer (8).
- 30 19. A method for manufacturing a plate heat exchanger including a number of heat exchanger plates, which are substantially manufactured in stainless steel containing chromium, and including a number of port channels extending through at least some of the heat exchanger plates, wherein one or more of the port channels are surrounded by a connection surface for connection of the port channel to a pipe member, wherein the method includes the steps of:
- 35 applying a material, which forms the connection surface and which permits brazing of said pipe member to the connection

- surface in a more easy manner than to stainless steel, wherein said material is more reduction susceptible than chromium dioxide,  
arranging the heat exchanger plates beside each other, and  
5 joining the heat exchanger plates to each other by means of a braze connection.
20. A method according to claim 19, wherein said material includes nickel.
- 10 21. A method according to anyone of claims 19 and 20, wherein said material includes copper.
- 15 22. A method according to anyone of claims 19 to 21, wherein said connection step includes a braze process with brazing of the heat exchanger plates at vacuum-like pressure conditions or in an atmosphere with substantially inert gas or a reducing gas.
- 20 23. A method according to anyone of claims 19 to 22, wherein the brazing is performed in such a manner that said material is bound to the stainless steel through diffusion.
- 25 24. A method according to anyone of claims 19 to 23, wherein one of said heat exchanger plates forms an outer heat exchanger plate having a respective outer surface area surrounding a respective port channel and wherein said application step includes that said material is applied to the outer surface area for forming said connection surface.
- 30 25. A method according to anyone of claim 19 to 24, wherein one of said heat exchanger plates forms an outer heat exchanger plate having a respective outer surface area surrounding a respective port channel and wherein the method includes the step of:

applying a connection member to the outer surface area at each port channel before said connection step, wherein the connection member forms said connection surface.

5 26. A method according to claim 25, wherein the connection member has a primary surface and wherein said application step includes applying said material to the primary surface for forming said connection surface by means of and during said  
10 braze process.

27. A method according to claim 26, including the initial step roughening the primary surface through blasting or the like for accomplishing rough surface finish facilitating wetting of the primary surface by said material during said braze process.

15 28. A method according to claims 25 to 27, wherein the connection member (8, 9) is substantially manufactured in stainless steel containing chromium.

20 29. A method according to claim 28, wherein the connection member (8; 9) is substantially manufactured in an alloy substantially containing copper and nickel.

25 30. A method according to claim 29, wherein said alloy includes 55 to 95 percent by weight copper and 5 to 45 percent by weight nickel.